

WHAT IS CLAIMED IS:

1. A method for demulsifying an emulsion comprising water and oil comprising the steps of:

- (a) oscillatory mixing said emulsion to produce an oscillatory mixed emulsion;
- (b) separating said oscillatory mixed emulsion into an oil phase and a water phase; and
- (c) recovering said oil and water phases.

2. The method of claim 1 wherein said oscillatory mixing is conducted at about a frequency corresponding to one of the fracture frequency of said emulsion.

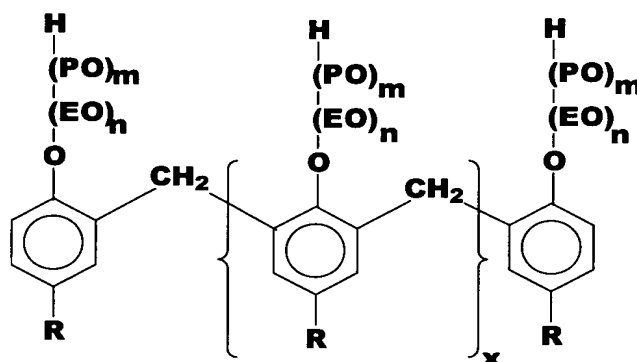
3. A method for separation of a water-in-oil emulsion in a process scheme including an on-line oscillatory mixer comprising the steps of:

- (a) collecting a water-in-oil emulsion from said process scheme;
- (b) determining the elastic modulus of the emulsion as a function of frequency in the frequency range of 0.1 to 75 radians per second;
- (c) determining the fracture frequencies of said emulsion from the said determination of the elastic modulus of the emulsion as a function of frequency;
- (d) setting the said on-line oscillatory mixer to oscillate at a frequency corresponding to any one of said determined fracture frequencies;
- (e) oscillatory mixing said water-in-oil emulsion in said on-line oscillatory mixer set to said determined fracture frequency; and
- (f) separating said mixed emulsion into a layer comprising water and a layer comprising oil.

4. The method of claim 1 further comprising adding chemical demulsifiers to said emulsion prior to or during said oscillatory mixing step (a).

5. The method of claim 4 wherein said chemical demulsifier is selected from chemical demulsifiers having a molecular weight of about 500 to about 5000 and a hydrophilic lipophilic balance of about 9 to about 35.

6. The method of claim 5 wherein said chemical demulsifier is a phenolformaldehyde ethoxylated alcohol having a formula:



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wherein R is selected from the group consisting of alkanes, alkenes, or mixtures thereof from 8 to 20 carbons, E is $\text{CH}_2\text{-CH}_2$ and P is $\text{-CH}_2\text{-CH-CH}_3$, n ranges from 1 to 5, m ranges from 0 to 5 and x ranges from 3 to 9.

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7. The method of claim 4 wherein said chemical demulsifier comprises chemical demulsifier and about 35 wt% to about 75 wt% of a delivery solvent selected from the group consisting of crude oil distillates, alcohols, ethers or mixtures thereof.

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8. The method of claim 4 wherein the chemical demulsifier is present in an amount from 0.005 to 3.0 wt% based on the weight of emulsion.

9. The method of claim 1 wherein the oil of said emulsion is selected from crude oil, crude oil distillate, crude oil resid, vegetable oil, animal oil, synthetic oil and mixtures thereof.

5 10. The method of claim 1 wherein the method is conducted at a temperature of about 10 to about 100°C.

 11. The method of claim 1 wherein said separation is accomplished by centrifugation, hydrocyclones, microwave, electrostatic field,
10 gravity settling and combinations thereof.

 12. The method of claim 11 wherein said centrifugation is conducted using a field which ranges from 500 to 150,000g for a time from 0.1 to 6 hours.

15 13. The method of claim 11 wherein said electrostatic field ranges from about 500 to about 5000 volts per inch for a time from 0.1 to 24 hours.

 14. The method of claim 1 wherein said water of said emulsion
20 contains dissolved inorganic salts of chloride, sulfates or carbonates of Group I and II elements of the long form of The Periodic Table of Elements.

 15. The method of claim 1 wherein said emulsion contains solids.

25 16. The method of claim 15 wherein said solids have an average total surface area of ≤ 1500 square microns.

 17. The method of claim 1 wherein said oscillatory mixing is conducted at frequencies in the range of about 0.1 to 75 radians per second.

18. The method of claim 1 wherein said oscillatory mixing is conducted in continuous or pulse mode.

19. The method of claim 1 wherein said emulsion is a water-in-oil
5 emulsion.

20. The method of claim 1 wherein said emulsion is an oil-in-water emulsion.

10 21. The method of claim 1 wherein said emulsion is a mixture of oil-in-water emulsion and water-in-oil emulsion.